

MASTER 2 Fundamental and Clinical Neurosciences

Internship proposal 2026-2027

(internship from January to June 2027)

Host laboratory: CRNL - CH Le Vinatier Bâtiment 462 - Neurocampus, 95 Bd Pinel, 69500 Bron

Host team : IMPACT

Internship supervisors : Claudio Brozzoli, CR, claudio.brozzoli@inserm.fr

Project title : Brain Plasticity at the Interface Between Tool Use and Syntax

Project summary :

This project investigates the links between the ability to use **mechanical tools** and **syntactic processing in language**. Previous work from our team has demonstrated that the **striatum**, within the basal ganglia, supports **supra-domain syntactic processes** involved both in: the execution of complex goal-directed actions with tools, and the processing of sentences with complex syntactic structures (Thibault et al., Science, 2021). Importantly, due to shared neural resources, training in one domain induces performance benefits in the other (Thibault et al., Science, 2021; Py et al., Current Research in Behavioral Sciences, 2025). However, the specific characteristics of tool-based actions that drive these cross-domain benefits remain unknown. This project aims to identify which features of tool-use actions (e.g., complexity, sequencing demands, hierarchical organization) are critical for inducing transfer effects to syntactic processing.

The student will:

- Take part in designing and implementing a **behavioral motor learning study**
- Manipulate **action complexity**, with and without tool use
- Measure transfer effects on **syntactic processing in language**
- Use **state-of-the-art kinematic recording techniques**, based on AI-driven algorithms for labeling and modeling manual movements
- Analyze behavioral and movement data to characterize action structure and learning dynamics

Depending on results and timing, the project may extend to the development of an **fMRI experiment** investigating the involvement of **striato-cortical networks** in the observed behavioral effects.

3-5 recent publications :

- Thibault S, Py R, Gervasi AM, Salemme R, Koun E, Lövdén M, Boulenger V, Roy AC, Brozzoli C. Tool use and language share syntactic processes and neural patterns in the basal ganglia. *Science*. 2021 Nov 12;374(6569):eabe0874. doi: 10.1126/science.abe0874.
- Raphaël Py, Marie-Hélène Grosbras, Claudio Brozzoli, Marie Montant. A tool to probe domain-general syntax: Simple and complex actions with a tool improve syntactic comprehension in language. *Current Research in Behavioral Sciences*. Volume 9, 2025, 100190, ISSN 2666-5182, <https://doi.org/10.1016/j.crbeha.2025.100190>.
- C. Brozzoli, A. C. Roy, L. H. Lidborg, M. Lövdén, Language as a tool: Motor proficiency using a tool predicts individual linguistic abilities. *Front. Psychol.* **10**, 1–9 (2019).
- Wenger E, Brozzoli C, Lindenberger U, Lövdén M. Expansion and Renormalization of Human Brain Structure During Skill Acquisition. *Trends Cogn Sci*. 2017 Dec;21(12):930-939. doi: 10.1016/j.tics.2017.09.008.